J.NAWROCKI, M. ANTCZAK, H. ĆWIEK, W. FROHMBERG, A. HOFFA, M. KIERZYNKA, S. WĄSIK

NUMERICAL METHODS

EX. 1. Complete the sentence. A Floating-point number is coded with using three elements: **……**, **……** and **…….**

EX. 2. Complete the name of elements defined below. The value of the floating-point number is computed with using the equation $\mathbf{x = s * 2^a * fp}$, where:

a) s – **……**.,

b) a – **……**.,

c) fp – **……**.

EX. 3. Represent below numbers with using floating-point numbers coding (*4-6):

0,8	-2	1,75	-5	0,3	9

EX. 4. Define the equation of a binary coding of the floating point $b_1b_2b_3..b_t$:

fp = ……

EX. 5. Represent below floating points with using 5bits binary coding (*4-6):

5/8	13/32	11/16	3/4	22/32	3/16

EX. 6. Define the equation which can be used to calculate an approximated value of the $\mathbf{e^x}$ function:

$\mathbf{e^x}$ **= ……**

EX. 7(*). Write a program with recurrence version of function which will be used to compute the approximated value of the $\mathbf{e^x}$ function assumed that the computation of the Taylor equation will be held to strict value defined as input parameter (not infinity) – example: e^x and x=3 => $e^3=1+(3^1/1!)+(3^2/2!)+(3^3/3!)$ (hint: $n = x$).

EX. 8. Write a program with recurrence version of function *numberOfDigits* that computes the number of digits of the natural number defined as input parameter.

ZAD. 9. Write a program with recurrence version of function *sumOfDigits* that computes the sum of digits of the natural number defined as input parameter.

EX. 10. Write a program with recurrence version of function *power* that computes the value of exponentiation function a^b where *a* and *b* are natural numbers defined as input parameters.

EX. 11. Write a program with recurrence version of function *multi* that computes the multiplication of two natural numbers *a, b* defined as input with using the method of multiple addition.

(*) asterisk marks problems which are not solved during exercise classes and should be solved as a homework

EX. 12. Write a program with recurrence version of function *gcd* that computes the value of a greatest common divisor (GCD) of any two natural numbers given as an input with using Euclides algorithm defined below:

$$\gcd(k,n) = \begin{cases} n & \text{dla } k = 0; \\ \gcd(n \bmod k, k) & \text{dla } k > 0. \end{cases}$$

EX. 13. Write a program with recurrence version of function *newton* that computes the Newton symbol value which is described with equations defined below:

$$\binom{n}{k} = \begin{cases} 1 & \text{gdy } k = 0 \text{ lub } k = n \\ \binom{n-1}{k-1} + \binom{n-1}{k} & \text{gdy } 0 < k < n \end{cases}$$

EX. 14. Write a program with recurrence version of function *legendre* that computes the value of Legendre polynomial which is described with equations defined below:

$$P_n(x) = \begin{cases} 1 \quad gdy \quad n = 0 \\ x \quad gdy \quad n = 1 \\ \frac{2n+1}{n+1} x P_{n-1}(x) - \frac{n}{n+1} P_{n-2}(x) \end{cases}$$

EX. 15. Write a program with recurrence version of function *hermite* that computes the value of Hermite polynomial for input, floating-point numbers which is described with equations defined below:

$$H_n(x) = \begin{cases} 1 \quad gdy \quad n = 0 \\ 2x \quad gdy \quad n = 1 \\ 2xH_{n-1}(x) - 2nH_{n-2}(x) \end{cases}$$

EX. 16.(*) Let's assume that a company is known which exists in the market over 3 years. It is December and the manager of this particular company wants to check the idea to compute workers salaries for a new year taking into consideration the salaries average from last three years and inflation coefficient *w*. We need to held a few simulations to help the manager make the decision.

Write a program with recurrence version of function *salary(s1, s2, s3, w, n)* that computes the worker salary for *n* years (when *n=0* the result should represent the worker salary at the beginning of new year, for *n=1* result should represent the worker salary in the next year and so on) with assumption that the average worker salary for a current year is stored in the *s1* input parameter, for a last year is stored in the *s2* input parameter and finally the year average salary from two years ago is stored in the *s3* input parameter. Input parameter *w* represents inflation coefficient, which for simplification will be the same in next *n* years (it is defined in the percentage scale – when *w=5* it means that the inflation will be on the level of 5%).

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